

CHAPTER – 16 Portland Cement Concrete Pavement-Portland Cement Concrete-02752-03055

General:

Concrete is a mixture of Portland cement, potable water, clean well graded sand, clean durable well graded gravel, and an air-entrainment admixture for mixes designated with an AE. Additional admixtures may be used to create certain characteristics for unique conditions and as permitted by the specifications. A concrete with the proper slump, air-entrainment, well-proportioned and quality aggregates and sand will result in a product of good performance and durability. To achieve this goal it is critical that the inspector ensure that acceptance tests are taken as required in the minimum sampling and testing requirements and that the concrete is placed in accordance with the requirements in the specifications.

Before a permanent or portable batch plant is allowed to supply concrete to a UDOT project the supplier must meet the requirements found in QMP 506 and the plant needs to be accepted on UDOT's approved ready mix supplier's list. All mix designs are reviewed and approved by the Resident Engineer and/or Region Materials Engineer prior to use. The inspector should confirm that these conditions are met before accepting concrete at the job site.

Plant Inspection: The inspector should carefully review Sections 01280 and 01455 1.9 of the standard specifications as well QMP 506 with the Resident Engineer prior to concrete mix being delivered to the project. The inspector may be required to obtain stockpile samples for acceptance testing. This provides an opportunity to ensure that the requirements in Sections 01280 and 01455 1.9 are being met on a regular basis. However more frequent random plant inspections may also be performed.

The following items are things to be considered in a batch plant inspection:

A. Bins

1. Bins with adequate and separate compartments for fine and coarse aggregates shall be provided in the batching plant.
2. Bin gates shall operate sufficiently enough to prohibit material from trickling into weight hopper. Bins must not be overfilled, or mixed aggregate could result.

3. Stockpiles should be built and maintained so contamination and segregation do not occur. Free moisture in the stockpiles should be checked by supplier and accounted for in batch water added.

B. Bulk Cement

1. Bulk cement shall be stored in weatherproof bins or silos.
2. Bins and silos shall be closed tight, and provide for free movement to the discharge opening.

C. Fly Ash

1. Fly Ash shall be stored in weatherproof bins or silos.
2. Bins and silos shall be closed tight, and provide for free movement to the discharge opening.

Check that unloading hoses for the cement and fly ash are of differing sizes as required in the specification.

D. Scales

1. All scales must be certified by the Utah Department of Agriculture, Weights and Measures Division, at least once a year or whenever moved.

E. Water

1. Water can be measured by volume or by weight.
2. The device for the measurement of water should be readily adjustable and capable of being set to deliver the required amount. The flow of water shall be cut off automatically when the required amount has been discharged.
3. Suitable type of water source.

F. Batch Tickets

1. The batch tickets should be checked for the following information:
 - a. Proper job number.
 - b. Proper job name.

- c. Bag mix.
- d. Class of concrete.
- e. Name and type of cement.
- f. Water cement ratio.
- g. Amount of water added.
- h. Time batched and date.
- i. Truck Number
- j. Number of cubic yards batched.

When receiving a concrete mix in the field the inspector should receive the batch ticket prior to use and perform all testing as required in UDOT standards. Additional water may be added in accordance with the specification. After all mixing is completed; the inspector reads and records both the water meter and revolution counter readings on the Batch Tickets. The completed batch tickets should be turned in for project documentation.

Portland Cement Concrete Paving Inspection: For concrete paving the following additional guidelines should be considered.

In preparation for paving, a pre-paving conference should be scheduled and held involving the Resident Engineer and his crew as well as the contractor's /sub-contractor's and material supplier's personnel who will be involved in the mix production and paving operations. The following items should be considered for the conference agenda:

- 1. Source of materials.
 - 2. Handling and stockpiling materials.
 - 3. Plant site.
 - 4. Equipment to be used.
 - 5. Method of operation.
 - 6. Key personnel and roles.
 - 7. Specification requirements.
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- a. Mix Requirements
 - b. Limitations (Hot and Cold Weather)
 - c. Sampling and Testing Requirements.

A. Paving Batch Plant

- 1. The Paving Batch Plant shall be used for both Lean Concrete Base (if required) and Portland Cement Concrete Pavement operations.

2. Requirements for a batch plant for concrete paving include the following.
 - a. A plant site, that is large enough to store a sufficient amount of material, for continuous operation.
 - b. A layout that allows traffic to flow freely into and out of the plant.
 - c. Properly adjusted equipment capable of rapid and accurate proportioning of the materials for each batch of concrete.
 - d. Reliable and rapid communication between the plant and the paving site
 - e. A platform from which the inspector can sample trucks for yield, consistency, slump, and air content. Locate the platform no farther than 250 ft from the mixer.

B. Lean Concrete Base Course

1. Introduction
 - a. Lean concrete base course is often placed under the concrete pavement for one or more of the following reasons:
 - (1) To prevent pumping.
 - (2) To provide increased and more uniform support for the concrete pavement, resulting in reduced edge deflection and stresses.
 - (3) To provide more stability during paving operations.
2. Base Course Preparation
 - a. The base course shall be carefully trimmed to Line and Grade.
 - b. Any soft spots that arise will be properly taken care of by the Contractor.
 - c. Compaction will meet required specifications before Lean Concrete Base Course operations proceed.
3. Paving Machines
 - a. General
 - (1) At the beginning of any paving operation, inspect the paving equipment. Ensure all equipment at the paving site is checked for compliance with specifications.
 - (2) Do not act for the contractor. If an adjustment is needed, have the contractor make the adjustment. Some

deflection will occur when a machine is under a load.
The final check must be made under a load.

b. Vibrators

- (1) The contractor will provide a monitoring system as required in the specifications for checking vibrators. If the system shows that a vibrator is not operating, the paving operation shall be stopped until the condition is corrected. Document all work stoppages. Contractor will check, and the Inspector will verify daily that vibrators are operating within specifications.
- (2) Vibrating must be discontinued whenever the forward motion of the paver is stopped. The speed of the slip-form paver should be as uniform as possible. Vary the speed of the paver with the rate of concrete delivered to minimize the possibility of the paver stopping on the fresh concrete.

c. Slip Form and Screed

- (1) The slip form and screed shall be clean and free from hardened concrete, during the paving operation. Mortar-paste building up between slip form and screed will cause tearing and/or raveling of the pavement.
- (2) The strike-off and extrusion plate shall be adjusted to produce the required section.
- (3) Check screed for proper grade and cross section profile.

d. Haul Trucks

- (1) Haul trucks should be checked for the following daily:
 - (a) Good mechanical condition.
 - (b) All trucks shall have backup warning devices.
 - (c) The dump bed interior surface shall be smooth and water tight, with round corners.
 - (d) Interior of the dump bed should be free from excessive accumulation of hardened concrete and from obstruction or deterioration sufficient to interfere with the discharge of concrete.
 - (e) The interior dump bed should be sprayed with a light coat of Form Release Oil at the beginning of each working day.

- (f) Safety chains will be installed on all tailgates to prevent the tailgates from opening and spilling concrete.

e. Finishing

- (1) After the screed has struck off the concrete , no additional finishing will be required, except the need to maintain line and grade.
- (a) The surface shall be true to grade and cross-section and free from irregularities.

f. Curing

- (1) The entire exposed area including sides and edges, shall be uniformly sprayed with curing compound. Curing shall commence as soon as finishing operations have been completed.
- (2) Curing compounds shall be applied with mechanical sprayers of the fully atomizing type.
- (3) Some check points for inspection are:
 - (a) The pavement surface must be exempt from freestanding water.
 - (b) The specified rate of application must be employed.
 - (c) The spraying device must be calibrated to give the proper rate of application.
 - (d) Nozzles on the spray device must be adjusted not to damage the pavement surface.
 - (e) Hand spraying shall supplement mechanical spraying if necessary.
 - (f) Apply a second application of curing compound at the specified rate within 48 hours before placing PCCP as a bond breaker.

C. Portland Cement Concrete Pavement

1. Base Preparation

- a. Base course or existing surface, shall be kept moist at least 500 feet in front of the paver.
- b. Avoid areas of standing water.

2. Line and Grade
 - a. The Contractor shall use previously established grade stakes on the underlying course or courses for grade control of the placing operations.
 - b. The Contractor shall furnish, place, and maintain such supports, wire devices, and materials as may be required to provide continuous line and grade reference controls to the placing machine, trimmers, etc.
3. Paving Batch Plant
 - a. The paving batch plant shall be used for both lean concrete base course and Portland Cement Concrete pavement operations.
 - b. Additional requirements for batch plant inspection for concrete paving shall include the following:
 - c. Platform inspectors should visually monitor each batch of concrete for consistency and uniformity as it is dumped into the truck. Trucks can be further tested if a visual problem is noticed.
 - d. All trucks should pass the platform, where inspectors shall observe the load and then direct the load to the grade.
 - e. Platform inspectors should document the time a load is batched and any unusual aspects of the load.
4. Paving Machine
 - a. Vibrators
 - (1) The contractor will provide a monitoring system as required in the specifications for checking vibrators. If the system shows that a vibrator is not operating, the paving operation shall be stopped until the condition is corrected. Document all work stoppages. Contractor will check, and the Inspector will verify daily that vibrators are operating within specifications.
 - (2) Vibrating must be discontinued whenever the forward motion of the paver is stopped. The speed of the slip-form paver should be as uniform as possible. Vary the speed with the rate of concrete delivered so that the paver never comes to a complete stop on the fresh concrete.
 - (3) The key to paving is a consistent mix that is placed consistently.

5. Tie and Dowel Bars

- (1) Tie and dowel bars shall be inserted at the rate specified in the Standard Specifications or Special Provisions and Plans. Check (watch) the tie and dowel bar insertion operation periodically. Be sure that the positioning of the tie bars is as planned.
- (2) For dowel bars, deviations from parallel shall be limited to 1/4 inch in the length of the bar.
- (3) Before any adjoining concrete placement, all bars shall be straightened to the proper position.
- (4) For tie-bars if an "A" shaped bend results from the straightening, the offset from a straight line should not be more than 0.1 ft.. If deviations exceed 0.1 ft., bar should be ground off and replaced.

6. Placement of Portland Concrete Cement Pavement

- (1) Concrete should be deposited continuously as near as possible to its final position.
- (2) The concrete should not be dumped in separate piles and then leveled and worked together; nor should the concrete be deposited in large piles and moved horizontally into final position.
- (3) If tie bars or dowel bars are suspended in basket assemblies do not allow wheeled or tracked equipment to redistribute discharged concrete.
- (4) Consolidate concrete around embedded items and reinforcement and entrapped air to eliminate stone pockets, honeycomb, and entrapped air. (This is accomplished by hand or by mechanical methods).
- (5) Bull floating or darbying must be complete before bleed water accumulates on the surface. Care must be taken not to overwork the concrete as this could result in a less durable surface.
- (6) A log sheet will be compiled from both the platform inspector and the paver inspector. This will contain, time of each truck and test results of each. Paver inspector will log in all stops, break down and problems with the paver.

7. Slip Form and Screed

- (1) The slip form and screed shall be clean and free from hardened concrete during the paving operation. Mortar-

paste can build up between slip form and screed will cause tearing and/or raveling of pavement.

- (2) The strike-off and extrusion plate shall be adjusted to produce the required section.

8. Finishing Equipment

- (1) Hand Finishing
- (2) Long handed floats smooth and fill in the open textured surface areas. (Keep hand finishing to the minimum.) Care must be taken not to overwork the concrete as this could result in a less durable surface.
- (3) If the surface cannot be brought to the desired conditions without continual use of hand operations, adjust paving operations or consistency of materials to bring the surface back to specified tolerances.
- (4) Additional water **sprayed** or **splashed** on the pavement to aid in finishing is not permitted.
- (5) No Evaporative aid shall be used.

9. Burlap Drag

- (1) The burlap drag should be a seamless strip of burlap, kept free of hardened concrete.
- (2) Use at least 3 plies of wet burlap and drag parallel to the centerline without tearing.
- (3) Complete the drag finish with one pass.

10. Texturing (new section in new spec hold on)

- (1) Transverse grooves shall be produced mechanically by means of a comb equipped with steel tines.
- (2) The grooving device shall form the grooves in one pass over the full width, without overlap.
- (3) Tines need to be checked for proper transverse grooves.

11. Curing Compounds

- (1) Curing compounds should be applied to all Portland Cement Concrete Pavements.

- (2) Special machines apply curing compounds to pavement surfaces, spraying the compound evenly.
- (3) Some check points for inspection are:
 - (a) The pavement surface must be exempt from freestanding water.
 - (b) The specified rate of application must be used.
 - (c) The spraying device must be calibrated to give the proper rate of application.
 - (d) Nozzles on the spray device must be adjusted so as not to damage the pavement surface.
- (4) Care shall be taken to ensure ample coverage with the compound edges, corners, and rough spots.
- (5) Hand spraying shall supplement mechanical spraying if necessary.

12. Sawing

- (1) When joints are sawed, the most important consideration is completing the sawing before uncontrolled cracking occurs, but not so early that sawing causes excessive spalling or joint ravelling.
- (2) When sawing, the concrete may crack ahead of the saw before the cut is complete. In this instance, the sawing operation should stop. If the saw cut is completed after the volunteer crack occurs, the concrete between the crack and the saw cut will eventually spall out.
- (3) Always wear hearing and eye protection when working around concrete saws.
- (4) Monitor depth of cuts.

13. Concrete Saw

- a. When sawing joints, the Contractor should provide the following sawing equipment:
 - (1) Diamond edge saw blades or abrasive wheel saw blades.
 - (2) At least one standby saw.
 - (3) An ample supply of saw blades.
 - (4) Artificial lighting facilities for night sawing.

14. Sawed Joints

- (1) The location of joints should be marked in such a manner that the marking will not be lost. For example, use a pin or stake beside the form and a stringline, snapped across the fresh concrete. (STD.DWD. No. 450-1A)
- (2) Saw cuts shall be in accordance with the requirements of Standard Specifications or Special Provisions.

15. Joints

- (1) **If necessary, the sawing operation should be carried on during the day and night, regardless of weather conditions.** Tearing and raveling of the concrete during sawing should be avoided.
- (2) Immediately flush all joints with water after sawing and wash cuttings from the road surface.
- (3) Thoroughly clean joints of all loose debris, cement powder, etc. with a jet of water at 2000 psi minimum pressure.
- (4) Saw remaining transverse contraction joints within 24 to 48 hours after the concrete has been placed. During cool weather, delay the sawing only for the time required preventing tearing and raveling of the concrete. The sawing of all joints shall be completed before placing concrete in adjacent lanes and before traffic is permitted on the pavement.
In succeeding lanes of concrete, joints should coincide with those in adjacent lanes to provide a continuous straight joint across the entire pavement width.

16. Joint Sealing

- (1) All joints, including contract joints, sawed longitudinal and transverse joints, transverse expansion joints, and joints between the bituminous shoulder and the concrete pavement shall be sealed with a joint sealer conforming to the requirements of State Standard Specifications or Special Provisions.

- (2) Before sealing, sawed joints shall be washed clean with water, completely dry and sealed within 48 hours after being sawed. The joint sealer shall be placed so that it is not higher than the pavement surface. Any excess filler shall be removed. Hot sealing material shall be stirred during heating so that localized overheating does not occur.

17. Joint Filler Backer Rod

- 18. Expansion joints shall be formed by means of a joint filler strip as specified in State Standard Specifications or Special Provisions.

Related Sections:

00555: Prosecution and Progress

01280: Measurement

01452: Profilograph and Pavement Smoothness

03152: Concrete Joint Control

03211: Reinforcing Steel and Welded Wire

03390: Concrete Curing

Portland Cement Concrete and PCCP
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SPEC	INSPECTION LEVEL	INSPECTION OBJECTIVE	INSPECTOR ACTIVITY
02752 03055	Important	Prepare for Paving Operations. Confirm approved Mix Design. Confirm Batch Plant has received approval.	Attend and participate in Pre-paving conference.
	Important	Ensure surface to be paved is properly prepared.	Inspect base surface to see it meets plan & specification requirements. Document findings in diary and reports.
	Important	Ensure equipment and processes in the field are as discussed in pre-paving conference.	Observe equipment, manpower, and level of contractor's preparedness and execution. Observe mix characteristics and finished product appearance. Document all information and limits of paving operations. Inform RE of any problems.
	Important	Ensure all required documentation, acceptance samples, and certification are procured, submitted and	Procure batch tickets, check to make sure they are properly filled out, take and ensure that all acceptance testing has been performed. Document all activities

	Intermittant	properly filed. Ensure cement, flyash, and stockpile samples are being tested as required.	and submit properly completed sampling paperwork and tickets. Coordinate with project, regional, and central lab personnel that necessary tests are being run and document findings.
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